4.0 CUMULATIVE IMPACTS AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

4.1 CUMULATIVE IMPACTS

The CEQ regulations for implementing NEPA defines cumulative impacts as:

> *". . . the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time"*[49]

Therefore, a cumulative impact analysis is based on a series of assumptions concerning future plans and/or projects and information about their character and timing. Cumulative impacts are examined by combining the effects of the proposed project alternatives with the effects of other past, present, and reasonably foreseeable activities in the regions of influence.

Past and Present. For a number of reasons, not all geothermal leases conclude with new geothermal development and production. The WFO has issued approximately 50 geothermal energy leases. Of these leases, only five were developed into producing plants (three power plants and two dehydration plants). Past and present surface disturbance within the WFO and Dixie Valley KGRA is approximately 600 acres (three WFO power plants, one Dixie Valley power plant, two WFO dehydration plants).

Future. The WFO currently has approximately 48 pending lease applications. Based on past and present leasing verses development/production statistics, we can reasonably expect that approximately another five new plants would result in development and production. Because power plants disturb more acres than dehydration plants, the "worse case" scenario is to project five new, 15-megawatt geothermal power plants as a "reasonably foreseeable development scenario." Using this projected estimate, we expect that approximately 1,200 acres of land would be disturbed as a result geothermal energy exploration, development, and production (approximately 600 past and present and approximately 600 reasonably foreseeable (see Table 2-2)). Using a baseline of approximately 2 million acres within the assessment area, this amounts to a total disturbance of approximately .0006 percent.

The cumulative impacts on hydrology and water quality; vegetation and noxious weeds; visual resources; wildlife, migratory birds, and fisheries; threatened, endangered, and special status species; geology and minerals; and hazardous materials/waste and solid waste could have undesirable effects if all five "reasonably foreseeable development scenario" power plants were approved to be built in the same geographical area or relatively near existing power plants.

[49] Council on Environmental Quality, Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR §§1500-1508)

However, if these five power plants were equally distributed throughout the assessment area, no appreciable cumulative impacts would result from the addition of these facilities individually or to the existing power plants.

4.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible commitments of resources are those resources that cannot be reversed or are lost for an extremely long period of time. Irretrievable commitments of resources are those that are lost for a short period of time (usually for the time period for which the resources are used) and that would be restored over time. There are no irreversible commitments of resources for leasing. However, if all five "reasonably foreseeable development scenario" facilities (five new 15-megawatt geothermal power plants) were to come on line together and concentrated within a small geographical area, there could be some irreversible and irretrievable commitments of the geothermal resources in that area. Over time, the geothermal resource temperature is expected to decrease to the point that it would no longer be economically feasible to use as a heat source for generating electrical power.

The following is a brief summary of the resources that could be expected to have irretrievable consequences:

Hydrology and Water Quality. Because of the large volume and long duration of geothermal fluid production, the production stage of resource development is likely to have to the greatest potential for impact to hydrologic resources. These impacts could occur in terms of changes to the hydraulics of the geothermal and groundwater reservoirs and spent geothermal fluid disposal. Hydraulic head pressures in the geothermal and adjacent groundwater reservoirs could change during production. The result could include reduction in spring discharge rates and lowering of water levels in wells. Disposal of spent fluids by injection could also affect hydraulic heads and could introduce low quality fluids to groundwater pathways that discharge at springs or wells. This could also affect the quality of available water. Surface disposal of spent fluids could create large pools of low quality water. Changes in spring flow and development of spent fluid holding ponds could induce changes to wetlands supported eco-systems and habitats. As a result, hydrologic impacts associated with geothermal development could have secondary impacts in the plant and animal community supported by natural or created wetlands.

Noxious Weeds. Introduction of noxious weeds into previously clean areas would be probable during all phases of geothermal development by construction and support vehicles. The development phase would present the greatest opportunity for noxious weed introduction and proliferation. Once introduced, control or eradication of noxious weeds could be difficult.

Visual Resources. Any changes in the characteristic landscape of the affected areas due to geothermal energy development could be visible for many years. Succession in the Basin and Range geomorphic province is very slow due to the lack of rainfall. Rehabilitation techniques could use non-indigenous plant species, thus changing the character of the area. The amount of contrast would vary by area, rehabilitation techniques, and the success of those techniques. All landscapes are unique in their own right and any change or loss of scenic values is irretrievable. Those losses become more significant in areas of unique or outstanding scenic quality.

Threatened, Endangered, and Special Status Species. Loss of any species is irretrievable. Protection of threatened, endangered, and special status species is governed by Federal and State statute. To minimize the effects on threatened, endangered, and special status species, the lessee would be required to complete a site-specific NEPA document outlining their proposed action and alternatives, and the direct and indirect impacts of their proposed action on any threatened, endangered, and special status species prior to any occupancy and surface disturbance.

Geology and Minerals. The principle commitment of resources in implementing the proposed action would be the depletion of thermal energy and water from the geothermal reservoirs tapped for energy use. To minimize this effect, the super-hot water extracted from the subterranean geothermal reservoirs through production wells is injected back into the reservoir for reheating and reuse. Over time, these resources (heat and water) could be depleted to the point that the power generating plant would no longer be economically productive.

Cultural Resources. Destruction and/or loss of cultural resources are irretrievable. Federal and State statute govern the protection of cultural resources. To minimize the effects on cultural resources, the lessee would be required to complete a site-specific NEPA document outlining their proposed action and alternatives, and the direct and indirect impacts of their proposed action on the cultural resources within the lease area prior to any occupancy and surface disturbance.

Hazardous Materials/Waste and Solid Waste. If handled improperly, hazardous materials/waste and solid waste have the potential to create irretrievable consequences. The storage, use, and disposal of hazardous materials/waste and solid waste are governed by Federal and State statute. To minimize the effects hazardous materials/waste and solid waste, the lessee would be required to complete a site-specific NEPA document outlining their proposed action and alternatives, and the direct and indirect impacts of hazardous materials/waste and solid waste associated with their proposed action prior to any occupancy and surface disturbance.

4.3 RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

The leasing of land for geothermal exploration and development involves the commitment of the available resources of the land, water, and air of the leased sites. It is significant to note that geothermal energy is a dissipating resource. The energy that is lost through natural heat transfer goes unused if it is not tapped and put into useful production. If left unused and undeveloped, not only is the potential energy ignored, but also a substantial revenue source for both county(s) and State is lost.

Geothermal resources are only limited by the amount of fluids available to transfer the thermal energy to the earth's surface, since the heat source itself is unlimited. Awareness of the duration of geothermal field capacity is found in the Geothermal Steam Act of 1970.[51] Section 1005 (a)

[50] Federal Land Policy Management Act of 1976 (43 USC §1701; 36 CFR §2310.1-2, 1600 Series)
[51] Geothermal Steam Act of 1970 (P.L. 91-582 as amended (30 USC §1001 *et seq.*))

and (b) of this Act allows a preliminary 10-year lease plus two successive 40-year extensions if commercial steam is being produced—a total of 90 years from initial lease issuance.

The exploration and testing phases of geothermal leasing are designed to determine the nature and extent of the geothermal resources. Generally the active portion of this phase is of short duration. Where such exploration proves unsuccessful, these lands would not be used for subsequent development and production. These lands would be restored, as much as possible, to their original condition upon termination of exploration and testing activities. However, if geothermal activities progress beyond the exploration and testing phase into long-term productivity, the lands could be affected to a greater extent. This would depend on the degree of development (i.e., surface disturbance) and the geothermal resource potential.

Over the long-term, while geothermal power plants are in production, these new electrical power plants would be producing a low-cost, clean source of renewable energy for use in Nevada and other western states. While in production, each plant would provide employment opportunities for citizens of the surrounding communities and the sale of this new electrical energy would be a new source of revenue for the counties within which they located, and for the State of Nevada.